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Enhancing project management performance through green innovation, quality planning and strategic leadership

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A B S T R A C T

This study investigates the impact of green innovation strategy on project management performance in the food sector of Saudi Arabia, examining the mediating roles of strategic quality planning and strategic leadership. Using a cross-sectional quantitative approach, data were collected in January 2025 from 341 employees through a convenience sampling technique. Structural equation modeling via SmartPLS was employed to analyze the data. Results indicate that green innovation strategy positively influences strategic quality planning (β = 0.655) and strategic leadership (β = 0.541), which in turn significantly enhance project management performance (β = 0.566 and β = 0.657, respectively). Additionally, strategic quality planning (β = 0.456) and strategic leadership (β = 0.505) partially mediate the relationship between green innovation strategy and project management performance. These findings highlight the critical role of green innovation and strategic management practices in improving project outcomes within Saudi Arabia's food industry.

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1. Introduction

Sustainability has become a critical priority for organizations worldwide due to growing environmental challenges, stricter regulatory requirements, and heightened expectations from stakeholders for responsible corporate behavior (Silvestri et al., 2024). Within this context, green innovation strategy has emerged as a vital approach, allowing firms to redesign their operations and business practices to reduce their environmental footprint. Green innovation strategy encompasses various activities such as reducing waste and emissions, adopting cleaner energy sources, enhancing resource efficiency, and implementing eco-friendly materials and processes (Le, 2022). The food sector, which traditionally contributes significantly to environmental degradation through high resource consumption and pollution, is at the forefront of adopting green innovations to meet sustainability objectives (Song & Yu, 2018; Soewarno et al., 2019).

Saudi Arabia's food sector plays a significant role in the country's economic development, especially under the transformative framework of Vision 2030, which aims to diversify the economy beyond oil dependency (Moshashai et al., 2020). The government has been actively promoting sustainable industrial growth and encouraging firms to implement innovative strategies that align with environmental sustainability. Despite these efforts, the practical integration of green innovation strategies within Saudi food companies faces challenges that require a better understanding of the organizational capabilities needed to ensure successful adoption and performance outcomes.

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Among the essential organizational capabilities supporting green innovation strategy, strategic quality planning and strategic leadership have gained prominence. Strategic quality planning involves systematic efforts to design, control, and continuously improve processes to meet both quality and sustainability goals (Woodruff & BenDor, 2016). It enables organizations to monitor operations closely, identify areas for improvement, and ensure that sustainability objectives are embedded into business processes (Gaspar et al., 2018). Strategic leadership, characterized by effective operations monitoring and clear articulation of vision, plays a pivotal role in driving organizational change toward sustainable development (Winch et al., 2022). Leaders who actively oversee business operations and communicate a compelling vision for a sustainable future are critical for motivating employees and aligning organizational efforts (Cortes & Herrmann, 2021). Although the importance of green innovation strategy, strategic quality planning, and strategic leadership has been recognized in enhancing project management performance, there remains limited empirical research examining the interplay among these variables, particularly in the Saudi food context. Project management performance (PMP)—defined as the ability to complete projects on schedule, within budget, and according to quality and client satisfaction standards—is a key indicator of organizational effectiveness and competitiveness (Mathur et al., 2013). Understanding how green innovation translates into improved project performance through strategic quality and leadership mechanisms can offer valuable insights for practitioners and policymakers. Previous studies have largely explored these constructs in isolation or focused on developed economies, leaving a gap in knowledge regarding their combined effects in emerging markets such as Saudi Arabia. Additionally, the mediating roles of strategic quality planning and strategic leadership in the relationship between green innovation strategy and PMP are underexplored in existing literature, especially within industries undergoing rapid transformation toward sustainability.

This study aims to address these gaps by investigating the direct influence of green innovation strategy on PMP and examining how strategic quality planning and strategic leadership mediate this relationship. The focus on employees within the food sector of Saudi Arabia offers a contextually relevant perspective that reflects the unique economic and cultural environment shaping organizational practices. By providing empirical evidence on these relationships, the study seeks to advance theoretical understanding and offer practical guidance on leveraging strategic capabilities to foster sustainable project success in the region's food industry.

2. Literature Review and Hypotheses Development

2.1 Green Innovation Strategy

Green innovation strategy refers to a firm's proactive efforts to integrate environmentally sustainable practices into its business operations and processes (Shahzad et al., 2021). This strategy goes beyond compliance with environmental regulations and emphasizes voluntary initiatives aimed at reducing negative environmental impacts. Green innovation strategy typically includes modifying production methods to reduce emissions and waste, adopting renewable energy sources, and redesigning products to minimize resource consumption (Khanra et al., 2022). The adoption of green innovations has become increasingly critical as organizations face rising environmental concerns and growing pressure from stakeholders to operate sustainably. Green innovation strategy is not only about environmental responsibility but also about achieving competitive advantages (Ge et al., 2018). Firms that successfully implement green innovations can reduce costs associated with waste and energy consumption, improve brand reputation, and respond better to market demands for sustainable products. Furthermore, green innovation strategy fosters innovation by encouraging firms to rethink traditional business models and develop new capabilities that align with sustainability principles (Tu & Wu, 2021). In the food sector, where resource use and pollution are significant concerns, green innovation strategy is particularly relevant for improving operational efficiency and reducing environmental footprints.

Despite its recognized benefits, the effective implementation of green innovation strategy requires supporting organizational capabilities (Sun & Sun, 2021). Simply adopting green technologies or practices without a strategic approach may limit the potential benefits. Hence, the alignment of green innovation strategy with other strategic processes within the firm is essential for translating sustainability efforts into improved organizational outcomes. Green innovation strategy requires systematic planning and quality control mechanisms to be effective (Wang & Juo, 2021). By integrating green initiatives into strategic quality planning, firms can ensure that environmental goals are consistently pursued across all processes. Strategic quality planning enables the alignment of quality improvement efforts with sustainability objectives, facilitating continuous monitoring and adjustment of green innovation activities. This integration helps firms to reduce errors, enhance operational efficiency, and realize the full benefits of green innovation strategy. Therefore, it is expected that firms with a strong green innovation strategy will demonstrate robust strategic quality planning capabilities.

H_1: *Green innovation strategy influences strategic quality planning.*

The successful implementation of green innovation strategy depends largely on the commitment and leadership of top management (Arici & Uysal, 2022). Strategic leaders who actively monitor operations and communicate a clear vision about sustainability are better positioned to drive green innovation (Lee & Huang, 2024). Their ability to inspire employees and align organizational efforts is crucial for overcoming challenges and ensuring that green innovation strategy becomes embedded in the company culture. Thus, a positive relationship between green innovation strategy and strategic leadership is anticipated, where firms investing in green innovations exhibit strong leadership behaviors oriented towards sustainability.

H_2: Green innovation strategy influences strategic leadership.

2.2 Strategic Quality Planning

Strategic quality planning is a systematic approach to planning and managing quality throughout an organization's processes to achieve long-term goals (Bolatan et al., 2022). It involves designing processes that ensure quality control, continuous improvement, and alignment with broader organizational objectives (Sui Pheng & Hui Hong, 2005). Strategic quality planning integrates quality management with strategic planning, enabling firms to embed quality considerations into all stages of operation, from product development to delivery (Beecroft, 1999). The role of strategic quality planning becomes even more critical when organizations pursue sustainability through green innovation strategy (Calingo, 1996). Quality planning ensures that green initiatives are not isolated efforts but are incorporated into the core business processes, thereby enhancing the effectiveness and consistency of sustainability practices. Through strategic quality planning, firms can monitor key performance indicators related to environmental goals, adjust operational plans accordingly, and foster a culture of continuous improvement. Moreover, strategic quality planning supports risk management and resource optimization, which are essential in managing the complexities of green innovations (Oschman, 2017). By planning quality strategically, organizations can anticipate potential challenges in implementing sustainability measures and develop proactive solutions (Kettunen & Kantola, 2007). This comprehensive approach helps translate green strategies into tangible outcomes, including improved operational efficiency and customer satisfaction.

Strategic quality planning directly influences PMP by ensuring that project activities are well-organized, monitored, and continuously improved (Chukwumah, 2015). Strategic quality planning provides a structured approach to managing quality in projects, which helps in meeting deadlines, staying within budget, and achieving desired quality outcomes (Shawyun, 2016). It also supports sustainability goals by embedding environmental considerations in project planning and execution. Hence, a positive association between strategic quality planning and PMP is expected.

H_3: *Strategic quality planning influences PMP.*

Given the strong linkages between green innovation strategy and strategic quality planning, and between strategic quality planning and PMP, it is plausible that strategic quality planning serves as a mediator in the relationship between green innovation strategy and PMP. This means that the effect of green innovation on project outcomes is transmitted through the firm's quality planning processes. Firms with effective strategic quality planning are more likely to translate their green strategies into successful project performance by ensuring that environmental objectives are integrated into project management.

H_4: *Strategic quality planning mediates the relationship between green innovation strategy and PMP.*

2.3 Strategic Leadership

Strategic leadership plays a pivotal role in guiding organizations through change, particularly when adopting innovative and sustainability-oriented strategies (Maddalena, 2012). Strategic leadership encompasses leaders' ability to monitor operations effectively and articulate a clear and compelling vision for the organization's future (Calabrò et al., 2021). Two key dimensions of strategic leadership are operations monitoring and vision articulating (Tsui et al., 2006). Operations monitoring involves leaders overseeing the organization's daily activities, ensuring that resources are used efficiently, and that processes align with strategic objectives. This dimension ensures accountability and provides the feedback necessary for continuous improvement. Vision articulating refers to leaders' capacity to communicate a forward-looking and inspiring vision that motivates employees, aligns stakeholders, and fosters commitment toward organizational goals. In the context of green innovation strategy, strategic leaders act as catalysts who champion sustainability initiatives and integrate them into the organizational culture. They influence how employees perceive green innovation efforts and encourage proactive engagement. Leaders who clearly communicate the importance of sustainability create a shared sense of purpose, which is crucial for overcoming resistance to change and embedding green practices within the firm (Mahdi & Nassar, 2021). Strong strategic leadership is also essential for coordinating cross-functional collaboration required for green innovation. By articulating a clear vision and maintaining operational oversight, leaders ensure that green initiatives receive the necessary support and resources, enabling their successful implementation (Wong et al., 2022; Shamim, 2022). Effective strategic leadership enhances PMP by providing clear direction, motivating teams, and ensuring operational control (Rivera-Ruiz & Ferrer-Moreno, 2015). Leaders who articulate a compelling vision and monitor organizational

activities help create an environment conducive to project success (Imam & Zaheer, 2021). In the context of green innovation, such leadership ensures that sustainability goals are prioritized and adequately resourced, resulting in improved project delivery. Therefore, a positive relationship between strategic leadership and PMP is proposed.

H_5: *Strategic leadership influences PMP.*

Similar to the mediating role of strategic quality planning, strategic leadership is also expected to mediate the relationship between green innovation strategy and PMP. Green innovation strategy's impact on project outcomes depends on the ability of leaders to champion sustainability initiatives and maintain oversight. Leadership behaviors that support environmental innovation foster alignment and engagement, which are critical for translating green innovation strategy into high project performance.

H_6: *Strategic leadership mediates the relationship between green innovation strategy and PMP.*

Fig. 1 depicts a research model.

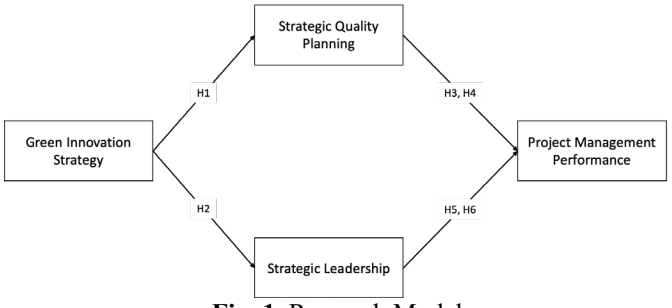

Fig. 1. Research Model

3. Methodology

This study utilized a cross-sectional design with a quantitative approach to examine the relationships between green innovation strategy, strategic quality planning, strategic leadership, and PMP. Data were collected in January 2025 from employees working in the food sector in Saudi Arabia, a key industry aligned with the country's Vision 2030 economic diversification goals. A total of 341 participants were selected using a convenience sampling technique. This sample size was chosen to ensure sufficient statistical power for structural equation modeling (SEM), which typically requires a minimum of 200 cases for reliable and valid estimation of complex models. The food sector was selected because of its critical role in Saudi Arabia's economic transformation, making it a relevant context for investigating sustainable business strategies. Convenience sampling was employed to efficiently access employees directly involved in project management and strategic planning within this sector, facilitating timely and practical data collection despite resource constraints. While convenience sampling limits the generalizability of the findings, the sample provides valuable insights from individuals with relevant industry experience. The survey instrument used "a five-point Likert scale" ranging from "strongly disagree" to "strongly agree" to measure all study variables. Green innovation strategy was measured with seven items adapted from Chan (2005). Strategic quality planning comprised eight items adapted from Djordjevic et al. (2018). Strategic leadership included seven items adapted from Tsui et al. (2006), covering two dimensions: operations monitoring (three items) and vision articulating (four items). PMP was assessed with five items adapted from Demirkesen and Ozorhon (2017). Data analysis was conducted using structural equation modeling through SmartPLS software to evaluate the measurement model and test the hypothesized structural relationships.

4. Results

The demographic profile of the respondents reflects a predominantly male sample, with 62% identifying as male and 38% as female. This gender distribution suggests a potential male dominance within the workforce or managerial roles in the targeted sector. In terms of age, the majority of participants (51%) fall within the 35–44 years range, indicating that mid-career professionals are the most represented group. A smaller portion (33%) is aged 25–34, and only 16% are between 45–54 years, highlighting a workforce that is largely composed of individuals in their prime working years. Regarding educational attainment, a significant majority (62%) hold a bachelor's degree, followed by 31% with a master's degree and a small fraction (6%) with an associate degree. This suggests a highly educated respondent pool, suitable for studies requiring managerial or technical insight. In terms of job roles, the largest group (47%) consists of mid-level managers, followed by senior managers (24%), entry-level employees (20%), and a smaller group of executives or directors (9%). This distribution emphasizes the focus on individuals with decision-making or supervisory responsibilities. Lastly, when examining years of experience, half of the respondents (50%) have between 2–5 years of professional experience, with 30% having 6–10 years and 21% having less than 2 years. This indicates a workforce with substantial but not extensive experience, aligning well with the mid-level management dominance observed earlier.

Table 1
Demographic of Study Participants (n=341)

Category	Subcategory	Frequency	Percentage
Gender	Male	213	62%
	Female	128	38%
Age	25–34 years	111	33%
	35–44 years	175	51%
	45–54 years	55	16%
Education Level	Associate degree	21	6%
	Bachelor's degree	213	62%
	Master's degree	107	31%
Current Job Position	Entry Level Employee	69	20%
	Mid-level manager	159	47%
	Senior manager	82	24%
	Executive/Director	31	9%
Years of Experience	Less than 2 years	71	21%
	2–5 years	169	50%
	6–10 years	101	30%

Table 2
Measurement Model

Constructs with items	Loadings	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
Green Innovation Strategy		0.809	0.829	0.658
GIS1: "To what extent has your firm modified its business practices or operations to reduce impact on animal species and natural habitats"	0.716			
GIS2: "To what extent has your firm undertaken voluntary actions (i.e., actions that are not required by regulations) for environmental restoration"	0.754			
GIS3: "To what extent has your firm modified its business practices to reduce wastes and emissions from operations"	0.873			
GIS4: "To what extent has your firm modified its business practices or operations (e.g., through recycling) to reduce purchases of non-renewable materials, chemicals, and components"	0.827			
GIS5: "To what extent has your firm reduced the use of traditional fuels by the substitution of some less polluted energy sources"	0.89			
GIS6: "To what extent has your firm modified its business practices or operations to reduce energy consumption"	0.705			
GIS7: "To what extent has your firm modified its business practices or operations to reduce the environmental impacts of its products"	0.842			
Strategic Quality Planning		0.738	0.749	0.702
SQP1: "Management plans each processes activity"	0.896			
SQP2: "Each business unit develops plans for quality implementation"	0.718			
SQP3: "Improvement of processes is a result of the implementation of operational plans for performance improvements"	0.84			
SQP4: "Achieved results are evaluated in a manner of comparing them with planned results in order to improve the process"	0.737			
SQP5 "In our company, there is an integrated process of strategic quality planning which is incorporated into a variety of internal and external information sources"	0.883			
SQP6: "In our company activities are planned in order to improve quality"	0.851			
SQP7: "In our company improvement of the processes that have defects is conducted"	0.803			
SQP8: "Long-term plans of our company also include the issues of facilities"	0.842			
Strategic Leadership		0.746	0.856	0.656
STO1: "We have a good manager over different projects and plans"	0.89			
STO2: "Our leaders monitoring the operation of the organization"	0.795			
STO3: "We have a tight control over the business condition of the organization"	0.724			
STV1: "Our leaders clearly communicating his/her vision about the future of the company"	0.868			
STV2: "Our leaders articulating a bright future for employees"	0.758			
STV3: "Our leaders clearly handling on the development of the company in the next five years"	0.855			
STV4: "Our leaders emphasizing the long-term planning of the company"	0.787			
Project Management Performance		0.892	0.737	0.575
PMP1: "Our company complete the project within schedule"	0.783			
PMP2: "Our company complete the project within budget"	0.734			
PMP3: "Our company achieve required quality"	0.884			
PMP4: "Our company achieve required safety"	0.796			
PMP5: "Our company satisfy the client"	0.804			

The measurement model results presented in Table 2 provide evidence supporting the reliability and validity of the constructs used in the study. Four key constructs were measured: green innovation strategy, strategic quality planning, strategic leadership, and PMP. Each construct was assessed using multiple items, with corresponding "factor loadings, Cronbach's alpha values, Composite Reliability (CR), and Average Variance Extracted (AVE)". Green innovation strategy shows strong internal consistency, with a "Cronbach's alpha" of 0.809 and a CR of 0.829. The AVE value of 0.658 exceeds the recommended threshold of 0.50, indicating good "convergent validity". All item loadings are above 0.70, except GIS1 (0.716) and GIS6 (0.705), which are still

acceptable. These results suggest that the items effectively capture the firm's environmental sustainability practices and innovation efforts. Strategic quality planning demonstrates good internal consistency as well, with a "Cronbach's alpha" of 0.738 and CR of 0.749. The AVE of 0.702 confirms adequate "convergent validity". The item loadings range from 0.718 to 0.896, showing strong individual contributions. This indicates that quality planning activities, such as process evaluation, defect reduction, and integration of strategic plans, are reliably measured. Strategic leadership also shows acceptable reliability ($\alpha = 0.746$; CR = 0.856) and a solid AVE of 0.656. All item loadings surpass the 0.70 threshold, suggesting that the items adequately reflect leadership behaviors including vision articulation, strategic monitoring, and long-term planning. These results indicate a coherent and valid measurement of strategic leadership within the organizations surveyed. PMP has a high "Cronbach's alpha" of 0.892, showing excellent internal consistency, though its CR is slightly lower at 0.737 and AVE at 0.575. Nonetheless, both values are above the acceptable minimum, indicating acceptable reliability and convergent validity. The loadings range from 0.734 to 0.884, suggesting that the items accurately capture various dimensions of project performance such as adherence to budget, timeline, quality, safety, and client satisfaction.

Table 3 presents the "discriminant validity results using the Fornell-Larcker criterion", which is a commonly applied approach to ensure that each construct in the model is distinct from the others. According to this criterion, the square root of the "Average Variance Extracted for each construct (displayed along the diagonal in bold)" should be greater than the correlations between that construct and any other constructs in the model. The square root of AVE for green innovation strategy is 0.811, which is higher than its correlations with strategic quality planning (0.655), PMP (0.699), and strategic leadership (0.541), indicating acceptable discriminant validity. Similarly, PMP has a square root of AVE of 0.813, which exceeds its correlations with the other constructs—green innovation strategy (0.699), strategic leadership (0.797), and strategic quality planning (0.615). Strategic leadership also demonstrates adequate discriminant validity, with a square root of AVE of 0.872, which is greater than its correlations with strategic quality planning (0.621), green innovation strategy (0.541), and PMP (0.797). Lastly, strategic quality planning shows a square root of AVE of 0.838, which is higher than its correlations with the other constructs.

Table 3
Discriminant Validity (Fornell-Larcker criterion)

	Green Innovation Strategy	PMP	Strategic Leadership	Strategic Quality Planning
Green Innovation Strategy	**0.811**			
PMP	0.699	**0.813**		
Strategic Leadership	0.541	0.797	**0.872**	
Strategic Quality Planning	0.655	0.615	0.621	**0.838**

Table 4
Path Coefficients

Paths	Beta	Standard deviation	T statistics	P values	Results
Green Innovation Strategy → Strategic Quality Planning	0.655	0.036	12.785	0.00	H1 supported
Green Innovation Strategy → Strategic Leadership	0.541	0.051	16.548	0.00	H2 supported
Strategic Quality Planning → PMP	0.566	0.177	9.372	0.00	H3 supported
Green Innovation Strategy → Strategic Quality Planning → PMP	0.456	0.151	8.372	0.00	H4 supported
Strategic Leadership → PMP	0.657	0.151	6.324	0.00	H5 supported
Green Innovation Strategy → Strategic Leadership → PMP	0.505	0.137	5.876	0.00	H6 supported

Table 4 presents the results of the "structural model analysis", highlighting the "path coefficients, standard deviations, t-statistics, p-values", and hypothesis testing outcomes. All six proposed hypotheses (H1–H6) are statistically supported, as indicated by the significant p-values (all 0.00) and t-values well above the critical threshold of 1.96 for a 95% confidence level. The direct effect of green innovation strategy on strategic quality planning ($\beta = 0.655$, $t = 12.785$) is strong and significant, supporting H1. This suggests that firms implementing green innovation strategies are likely to have well-structured quality planning processes. Similarly, green innovation strategy also positively influences strategic leadership ($\beta = 0.541$, $t = 16.548$), supporting H2 and indicating that environmentally driven initiatives foster strategic leadership behaviors. Strategic quality planning has a significant positive impact on PMP ($\beta = 0.566$, $t = 9.372$), confirming H3. This means that better planning processes, likely developed through structured quality efforts, enhance a firm's ability to deliver projects successfully. In addition, strategic quality planning mediates the relationship between green innovation strategy and PMP ($\beta = 0.456$, $t = 8.372$), supporting H4. This mediation suggests that the effect of green innovation on performance is partially channeled through quality planning mechanisms. Strategic leadership also shows a significant direct effect on PMP ($\beta = 0.657$, $t = 6.324$), supporting H5. This emphasizes the role of effective leadership in achieving project goals. Finally, strategic leadership mediates the relationship between green innovation strategy and PMP ($\beta = 0.505$, $t = 5.876$), supporting H6. This indicates that the influence of green strategies on performance outcomes also operates through leadership practices.

The R^2 values presented in Fig. 2 reflect the proportion of variance explained in the dependent variables by the predictors in the model, offering insight into the model's explanatory power. The R^2 value for strategic quality planning is 0.731, meaning that 73.1% of the variance in strategic quality planning is explained by the green innovation strategy. This is considered a substantial level of explanatory power, indicating that green innovation efforts strongly contribute to how firms plan and implement quality initiatives. Similarly, the R^2 value for strategic leadership is 0.707, suggesting that 70.7% of the variance in strategic leadership practices is explained by the green innovation strategy. This reflects a strong relationship, emphasizing that organizations with robust environmental strategies are likely to cultivate stronger leadership that aligns with long-term goals and sustainability. Lastly, the R^2 value for project management performance is 0.805, which is notably high. It indicates that 80.5% of the variance in project management performance is jointly explained by strategic quality planning and strategic leadership.

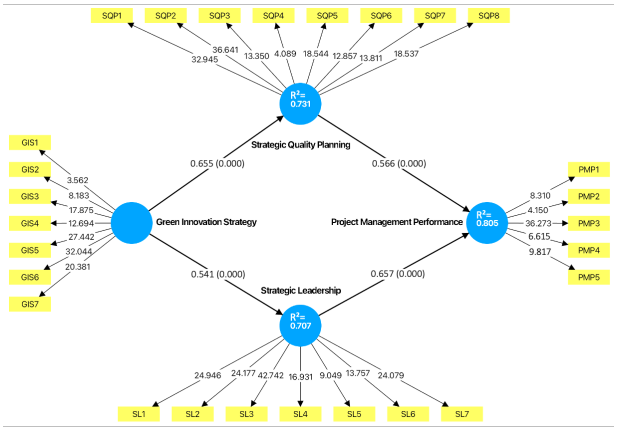

Fig. 2. Structural Model

5. Discussion

The findings of this study provide valuable insights into the role of green innovation and strategic management practices in enhancing project performance, especially in the context of Saudi Arabia's economic diversification and sustainability agenda. The results confirm that green innovation strategy significantly influences both strategic quality planning (β = 0.655) and strategic leadership (β = 0.541). This suggests that firms that adopt proactive environmental initiatives—such as reducing waste, using clean energy, and minimizing environmental harm—are more likely to develop structured quality planning systems and strong strategic leadership (Le, 2022; Oschman, 2017). These findings reinforce the argument that green innovation serves not only environmental objectives but also strengthens internal organizational capabilities.The relationship between strategic quality planning and project management performance (β = 0.566) further demonstrates the importance of aligning organizational planning with quality and sustainability principles. Effective quality planning appears to serve as a critical mechanism for translating green strategies into actionable improvements in project execution (Bolatan et al., 2022). In the Saudi context, where projects often involve complex timelines and ambitious performance targets under Vision 2030, structured planning practices driven by sustainability can provide a competitive advantage. Similarly, strategic leadership has a strong positive impact on project management performance (β = 0.657), indicating that leadership plays a pivotal role in steering project teams toward successful outcomes. Leaders who possess strategic foresight and clearly communicate long-term visions are better able to mobilize teams and resources effectively (Ahmed et al., 2021). In Saudi Arabia, where many organizations are undergoing rapid transformation, leadership that incorporates sustainability into strategic decision-making is vital for long-term success. The mediation analysis provides further depth to these relationships. The mediation effect of strategic quality planning in the relationship between green innovation strategy and project management performance (β = 0.456), and the mediation of strategic leadership in the same relationship (β = 0.505), confirm that both strategic planning and leadership act as critical conduits through which green innovation drives project performance. These findings highlight the importance of integrating sustainability into both leadership development and operational planning frameworks to achieve performance excellence.

This study offers several implications in Saudi Arabia, a country actively pursuing sustainable development through its Vision 2030 initiative. The strong positive influence of green innovation strategy on both strategic quality planning and strategic leadership suggests that organizations should prioritize environmental sustainability not just as a compliance requirement but as a core element of their strategic agenda. Firms that embed green innovation into their business models are likely to develop more effective planning systems and leadership capabilities, which are essential for achieving superior project outcomes (Shahzad et al., 2021). This aligns well with Saudi Arabia's broader goals to diversify its economy while reducing environmental impact. For

organizational leaders, the findings highlight the necessity of cultivating a leadership style that emphasizes sustainability, strategic vision, and long-term planning. Developing leaders who can effectively integrate green innovation into business operations will enhance project management performance, as shown by the significant path coefficient between strategic leadership and project outcomes. Leadership development programs within Saudi companies should therefore include training on sustainability principles and strategic environmental management to build capacity aligned with national priorities. The role of strategic quality planning as a mediator between green innovation and project performance underscores the importance of structured, quality-driven processes in transforming sustainability initiatives into tangible project success. Companies in Saudi Arabia, especially in sectors like construction, energy, and food, should invest in improving their quality management systems with a focus on environmental considerations. This will ensure that projects are delivered efficiently, meet quality standards, and contribute to environmental goals, supporting Saudi Arabia's reputation as a forward-looking business environment. At the policy level, the evidence from this study supports the development of stronger regulatory frameworks and incentive mechanisms to encourage green innovation adoption across industries. Ministries and regulatory bodies can play a pivotal role by introducing guidelines, certifications, and financial incentives that motivate companies to incorporate sustainable practices into their strategic leadership and quality planning processes. This, in turn, will boost the overall competitiveness and sustainability of the Saudi economy. Finally, the educational sector in Saudi Arabia can benefit from these findings by integrating sustainability-focused curricula into business, engineering, and management programs. Equipping future managers and leaders with knowledge and skills in green innovation, strategic planning, and leadership will prepare a workforce capable of supporting the Kingdom's sustainable development goals. This alignment between academia, industry, and government will be critical in driving the country's transition toward a greener, more resilient economy.

6. Conclusion

This study highlights the significant influence of green innovation strategy on improving project management performance through the mediating roles of strategic quality planning and strategic leadership. The strong positive relationships indicate that organizations that actively implement environmentally sustainable innovations tend to develop more robust quality planning processes and effective leadership practices. These, in turn, contribute to enhanced project outcomes in terms of meeting schedules, budgets, quality standards, and client satisfaction. In the context of Saudi Arabia's Vision 2030, which emphasizes economic diversification and environmental sustainability, the findings are particularly relevant. The results suggest that Saudi firms can gain competitive advantages by embedding green innovation into their strategic planning and leadership frameworks. Such integration supports not only environmental goals but also improves operational efficiency and project success. These elements are crucial for the successful delivery of complex projects typical in Saudi Arabia's growing industries, such as construction, energy, and food.

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